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## Notes on Some Injurious Fungi of California.<sup>1</sup>

BY W. G. FARLOW.

During a recent trip to California I had an opportunity of observing some injurious fungi which attack the native plants, and as they may hereafter be the cause of disease in cultivated plants, it may be well to call the attention of the members of the Association to a few facts with regard to them.

In traveling in Mexico the attention of the botanist is attracted by the pleasing foliage and graceful habit of *Nicotiana glauca* Grah., which is abundant along the railroads and highways, where it often attains a height of ten feet or more. This shrub or small tree is a native of Buenos Ayres, but is thoroughly acclimated in Mexico, and is occasionally cultivated in the green-houses of our Northern States. Within a few years it has escaped from cultivation in California and is now a common roadside plant from San Diego to Los Angeles and Santa Barbara, and also occurs, but less commonly, still further to the north. While in San Diego I noticed that the leaves of the *Nicotiana* were badly attacked by a fungus which formed large grayish-black spots on both sides of the leaves. The spots were often two inches in diameter, and sometimes even larger, and the circumference was irregular but sharply limited, so that the transition from the healthy to the diseased leaf tissue was sudden.

A microscopical examination shows that the fungus in question is *Peronospora Hyoscyami* De By., which was first found on *Hyoscyamus niger* L., in Europe, where it does not appear to be at all common. Both in Europe and California the spots formed on the leaves are large, and the surface is densely covered with a luxuriant growth of conidia, but, so far as I know, no oospores have yet been found in this species.

Since it is well known that the species of *Peronospora* attack different species of flowering plants which belong, botanically speaking, to the same natural order, it is much to be feared that the disease which now attacks *Nicotiana glauca* may sooner or later extend to the cultivated tobacco, which belongs to the same genus. If this happens, the injury to the tobacco would be very great, since by causing large spots on the leaves to rot they would become worthless for manufacturing purposes. We must at least consider the probabilities with regard to the spreading of the disease. The fungus was only observed by me at San Diego, but it was abundant there. Whether it occurs in Mexico or not I can

<sup>1</sup> Read before the American Association for the Advancement of Science, August, 1885.

not say, but my opportunity for observing in that country was so limited that the fungus might have been very abundant there and still escape my notice. At Santa Barbara, however, I was able to make a pretty careful search, and as far as I could ascertain, the disease has not yet made its appearance there, but from what we know of the history of the spreading of diseases caused by other species of *Peronospora*, there is every reason to suppose that the disease which we are now considering will soon reach Santa Barbara. As tobacco is not an important crop in California, we are less interested in the spreading of the disease in that State than in its extension to the southern states. The *Nicotiana glauca* may perhaps spread northward and eastward until it reaches the gulf states, carrying with it the *Peronospora*, but it is too tender to stand the winters further north without protection. What is also to be feared is that in advancing eastward the fungus may be communicated to some species related to the *Nicotiana glauca*, as for instance *Hyoscyamus niger*, and thus be transported north of the limit where the *Nicotiana glauca* might grow, but where *N. Tabaccum*, the tobacco plant, is cultivated. But this supposition is almost superfluous, because if *Nicotiana glauca* and its parasite are once introduced into the gulf states the parasite might attack the tobacco grown there, and then pass on to Virginia and other states where tobacco is the most important crop.

At the Minneapolis meeting I stated in a paper read before the Association that *Peronospora Halstedii*, although one of the commonest species on Compositæ in the eastern and central states, had not yet been found either in the extreme south or on the Pacific coast. I am indebted to Dr. H. W. Harkness for specimens of a *Peronospora* growing on *Madia sativa*, near San Francisco, which is identical with *P. Halstedii*, so that this typically American species extends quite across the continent. *Peronospora leptosperma* of De Bary, known in Europe and the Mississippi valley, I also found to be common at Santa Barbara and Santa Cruz, on *Artemisia Ludoviciana*.

The hollyhock disease, *Puccinia Malvacearum* Mont., which was originally noticed in Chili, has in recent years spread over Europe, and its progress has been more carefully watched by botanists than that of any other plant disease, the potato-rot and grape-mildew perhaps excepted. But while the two diseases last named extended to Europe by way of North America, the hollyhock disease, apparently, was conveyed directly from South America to Europe, and did not pass through the United States.

The only reference<sup>2</sup> to the existence of the hollyhock fungus in this country is in the catalogue of Pacific coast fungi by Harkness and Moore, where it is said to have been found on *Malva*, near San Francisco. A fungus related to the hollyhock fungus has been observed on species of *Malvastrum* in the western states and California. It was first seen by Mr. D. Cleveland, near San Diego, in 1875, and has been seen several times since. By some the fungus on *Malvastrum* has been considered distinct, and even those who have considered it a variety of *P. Malvacearum* have regarded it as distinctly unlike the form found on hollyhocks. When in California I examined with care the different Malvaceæ, to which order the hollyhock belongs, to see whether the true hollyhock fungus did not occur in that state. During a visit to the garden of Mrs. Elwood Cooper, near Santa Barbara, I found the hollyhock covered with a *Puccinia*, and in a canyon near the garden I also found a few leaves of *Malva borealis* L., on which was the same fungus. I at first supposed that what I had found was the hollyhock disease of Europe and South America, but closer examination and a careful comparison with European specimens showed that the form found at Santa Barbara was not the European form, but, on the contrary, precisely the form already known on *Malvastrum* in this country. This is to me rather surprising, for if the fungus on *Malvastrum* is only a variety of the hollyhock fungus, when the disease appears on hollyhocks in this country it should appear in its typical form; and, on the other hand, if the *Malvastrum* fungus is really a distinct species then the hollyhock disease of Europe is not the hollyhock disease of this country, although both are caused by nearly related *Pucciniae* of the sub-genus *Leptopuccinia*. A detailed account of the differences recognized in the two forms mentioned is only of interest to mycologists, and a discussion of the subject will come up more appropriately in another connection. In case of the fungus in question, one should consider the possibility that it may attack the cotton plant<sup>3</sup> at some future date, although Cesati states that *Puccinia Malvacearum* has not attacked the cotton in Italy. As far as our own cotton is concerned, danger is rather to be apprehended from *Puccinia heterospora* B. & C., which in its different forms is widely distributed on different Malvaceæ in the southern states.

<sup>2</sup>The mention by Burrill in *Bull. Ill. Lab. Nat. Hist.*, and the several items in the *Gardener's Monthly*, at different dates, all refer to some other disease.—Eds.

<sup>3</sup>Plowright found by direct experiments that the true *P. Malvacearum* will not grow upon the cotton plant. See *Science*, V. p. 2.—Eds.